M@hbub

Soil Salinity and Alkalinity

Saline Soil

Saline soil may be defined as the soil having a conductivity of the saturation Extract greater than 4mmhos/cm, exchangeable Sodium Percentage (ESP) less than 15 and P^H less than 8.5.

When the soil contains excess of Sodium salts and clay complex still contains exchangeable Calcium, the soil is known as saline soil or White alkali or Brown alkali soil. The process of salts leading to formation of soil is known as salinization.

Characteristics of Saline Soil

- In dry season, a layer of white crush is formed over the surface. So, it is called white alkali.
- ESP is very low, being less than 15% of total cation exchange capacity.
- P^H varies between 7.5 to 8.5.
- Total soluble salt content is more than 0.1%. It is high enough to interfere with normal growth of most plant species.
- Electrical conductivity(EC) of solution extract (saturated) is 4 or more than 4 mmhos/cm.
- Saline soil remain in flocculated condition granulated. It is permeable to water and soil.
- Soluble salt like sulphate, chloride and carbonates of sodium, magnesium, calcium are present.

Management of Saline Soil

A. Mechanical method

1. **Flooding and leaching down of soluble salts-** The leaching can be down by first ponding water on land and allowing it to stand, therefore a week. Most of the soluble salt would leach down below the root zone. After a week, standing water is escape. such 2-3 treatment are given to reclaim highly saline soil. Gypsum is added to flood water when the soluble salt are low in calcium to check development of alkalinity.

2. **Scraping of surface soil-** When soluble salt accumulate on the soil surface, scraping help to remove salts. This is a tempority cure.

B. Cultural Method

1. **Providing proper drainage-** If the soil is not free draining, artificial drains are open to wash out the salts.

2. **Use of salt free irrigation water-** salt free irrigation water should be used.

3. **Proper use of irrigation water-** If the amount of water in the soil is decrease the concentration of salt in the soil solution is increase. Thus moisture should be kept at optimum field capacity.

4. **Use of acidic fertilizer-** Acidic nature of fertilizer should be used.

5. **Use of organic manures-** Organic manure have high water holding capacity. When sufficient amount

of organic manure are added the water holding capacity of soil are increases. As a result, the conductivity of the soil solution decreases.

6. **Ploughing and levelling of land-** Ploughing and levelling increases the infiltration and percolation rate of the land. Thus salts leach down to the lower level.

7. **Retardation of water evaporation from soil surface-** Water may be conserved in the soil by retarding the water evaporation. Thus salts remain the lower level with the water**.**

8. **Planting or sowing seeds in furrow-** Water generally evaporates from the highest surface by capillarity. Seedling are planted inside the furrows, they escape the zone of maximum salt concentration. Thus seedling can growth germinate and develop properly during early stage **.**

9. **Growing of salt tolerant crops-**

    - ***High salt tolerant crop***- Burley, sugar beet, cotton etc.
    - ***Moderately salt tolerant crops-*** wheat, rice, sorghum, maize etc.
    - ***Low salt tolerant crop-*** Bean, radish etc.
    - ***Sensitive crops-*** Tomato, potato, onion, carrot.

Alkaline Soil

These soil which contains appreciable quantities of exchangeable sodium and may or may not contain excess soluble salts are known as alkali soil.

Characteristics of Alkaline soil

- In dry season, a layer of black crush is formed over the surface. so it is called black alkali.
- Electrical conductivity (EC) 4 mmhos/cm.
- P^H is 8.5 - 10.
- Exchangeable Sodium Percentage (ESP) is 15.

Classification of Alkali soil

There are 3 types-

1. **Saline alkali soil-** when they contain soluble salts in excess, they are known as saline alkali soil.
2. **Non-Saline alkali soil-** when they do not contain soluble salts are called non saline alkali soil.
3. **Degraded alkali soil-** Under certain circumstances, the clay complex of some alkali soil is broker down to give rise to degraded alkaline soil.

Management of Alkali soil

A. Chemical Method

1. Application of Gypsum- By cationic exchange, calcium is often used to replace sodium in alkali soil. If the soil has no reserve Calcium carbonate, the addition of gypsum is necessary. When gypsum is used as

reclaiming agent, Calcium replace the exchangeable sodium and converts the clay back into calcium clay.

$$Na_2CO_3 + CaSO_4 \rightarrow CaCO_3 + Na_2SO_4$$

Use of Sulphur- If the alkaline soil contain free calcium carbonates, sulphuric acid application is effective for reclaiming the soil. When sulphur is spread on the soil, it is oxidized to sulphuric acid, which converts sodium sulphate. If calcium carbonate is not present in the soil, It should be added artificially when sulphur is used for reclamation.

$$2S + 2H_2O + 3O_2 \rightarrow 2H_2SO_4$$

$$Na_2CO_3 + H_2SO_4 \rightarrow CO_2 + H_2O + Na_2SO_4\downarrow$$

$$2CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + Ca(HCO_3)_2$$

Addition of organic matter- The addition of organic matter increases acidity thus helping in lowering the soil p^H.

Use of sulphuric acid- Sulphuric acid changes to sodium carbonates to the less harmful sulphate and reduce the alkalinity of soil.

$$Na_2CO_3 + H_2SO_4 \rightarrow CO_2 + H_2O + Na_2SO_4\downarrow$$

Addition of molasses- Addition of molasses in the soil provide the source of energy for micro organism which on fermentation produce organic acid. The organic acid reduce alkalinity.

B. Cultural Method

1. **Providing proper drainage-** If the soil is not free draining, artificial drains are open to wash out the alkalinity of soil.

2. **Proper use of irrigation water-** If the amount of water in the soil is decrease the concentration of alkalinity in the soil solution is increase. Thus moisture should be kept at optimum field capacity.

3. **Use of acidic fertilizer-** Acidic nature of fertilizer should be used.

4. **Use of organic manures-** Organic manure have high water holding capacity. When sufficient amount of organic manure are added the water holding capacity of soil are increases. As a result, the conductivity of the soil solution decreases.

5. **Ploughing and levelling of land-** Ploughing and levelling increases the infiltration and percolation rate of the land. Thus alkalinity leach down to the lower level.

6. **Retardation of water evaporation from soil surface-** Water may be conserved in the soil by retarding the water evaporation.